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Performance of Cashew and Noni Inter Cropping System Under Organic Condition in Chikmagalore District of Karnataka

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Abstract A study was undertaken to evaluate the performance of cashew and noni, a medicinal fruit crop as an inter crop for consistent and stabilized yield. The study revealed that there was no significant yield difference between mono cropping and inter cropping system in cashew which was 2.52 and 2.51 tonne per ha of raw cashew nut respectively. No significant difference was seen with regard to organic carbon content in the soil of mono cropping and inters cropping system. Inter cropping of noni a medicinal plant in cashew plantations brought the higher benefit cost ratio for cashew farmers compared to farmers of traditional mono cropping system who could earn from Rs 2.48 to Rs 3.03 against the every rupee invested. Inter cropping of noni, a medicinal plant in cashew plantations would generate employment opportunities for improving the quality of rural life. Apart from increasing the production of additional crops and employment potential, inter cropping system can acts as a social security against instability in yield such as crops loss.

Keywords Noni, Organic-farming, Cashew nut, Yield, Soil organic matter.

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Introduction

Intercropping can be defined as an agricultural practice of cultivating or growing of two or more crops simultaneously on the same area of land for increasing the returns from unit area of land. The crops are not necessarily sown at exactly the same time and their harvest times may be quite different, but they are usually "simultaneous" for a significant part of their growing period. It is a practice often associated with sustainable agriculture and organic farming. Intercropping is one form of polyculture, using companion planting principles. Intercropping may benefit crop yield or the control of some kind of pest, or may have other agronomic benefits. In intercropping, there is often one main crop and one or more added

crops, with the main crop being the crop of primary importance because of economic or food production reasons. The two or more crops used in an intercrop may be from different species and different plant families, or they may simply be different varieties or cultivars of the same crop species. Intercropping offers farmers the opportunity to engage nature's principle of diversity on their farms. Intercrops can be more productive than growing pure stands.

Cashew is a native of North-Eastern Brazil and is now distributed all over the tropics and parts of warm sub-tropics. The English name of cashew is said to be derived from Portuguese word 'caju' [1]. From Brazil, cashew was introduced to India by the Portuguese in the sixteenth century mainly for soil conservation and afforestation in the coastal region. Presently, cashew is cultivated in 32 countries of Latin America, Asia, Africa and Australia, covering an area of about 53.13 lakh hectares with a production of 41.52 lakh tonnes of raw nuts with an average productivity of 0.78 t/ha. Cashew is now widely grown in many tropical regions with Vietnam and Nigeria major producers, in addition to India, the Ivory Coast, and Indonesia. Cashew (*Anacardium occidentale* L.) is an important export earning crop of the country which has earned a foreign ex-change of Rs 2,598 crores through export of cashew kernel and an additional Rs 31.85 crores by export of the cashew nut shell liquid in 2010-11. Indian cashew industry is almost export oriented. It provides employment to more than 5 lakh people both directly and indirectly, particularly in the rural areas and it thus plays a very vital role in the economy.

Cashew is generally grown as a rainfed crop on neglected land unsuitable for any other crop. It c is a tropical evergreen tree that produces the cashew nut and the cashew apple. Botanically known as *Anacardim occidentale* L., it can grow as high as 14 meters (46 ft), but the less vigorous cashew, growing up to 6 meters (20 ft), has proved more profitable, with earlier maturity and higher yields.

The fruit of the *Morinda citrifolia* plant, or "noni" known in Sanskrit as Ayushka, is valued by traditional Ayurveda for its health benefits, as it is rich in vitamins A, B-Complex, C, E and K_2 and minerals like calcium, iron niacin, phosphorus, magnesium,

Table 1. Growth and yield (kg/ha) of cashew under organic and inorganic practices.

		2014–15	
Sl. No.	Growth & yield parameters	Mono cropping	Inter cropping
1	Girth of stem (cm)	41.90	42.10
2	Height of plant in (m)	4.54	4.60
3	Weight of kernel (g)	2.90	2.89
4	Weight of nut (g)	7.81	7.80
5	Number of nuts per plant	2658.20	2658.10
6	Yield in tons per ha (Spacing 30 × 30 feet)	2.52	2.51

zinc, copper and other minerals like chromium, manganese, molybdenum, sodium, potassium. It has been known for thousands of years by tropical cultures and has recently been introduced to the general public as a dietary health supplement [2]. The proxeronine in the noni juice gets in to the body to produce more xeronine. Xeronine is a small alkaloid that is required in picrogram (trillionth of gram) amounts and is essential to the correct functioning of the body. Large amounts are used in times of physical or mental stress. Xeronine is produced in the body from proxeronine and the enzyme proxeronase in the small intestine. All healthy cells require Xeronine to function correctly. With the help of xeronine, which modifies the shape of proteins, enzymes and receptor-sites, the cell then flushes out impurities such as toxins, bacteria, viruses, which inhibit its purpose [3]. Noni has traditionally been used for colds, flu, diabetes, anxiety, and high blood pressure, as well as for depression and anxiety. All plant parts are used for a variety of illnesses in Samoan culture, and noni is one of the most frequently used Hawaiian plant medicines. Increased/indiscriminate use of chemical fertilizers and pesticides during green revolution period resulted in several harmful effects on soil, water and air causing their pollution. This has reduced the productivity of the soil by deteriorating soil health in terms of soil fertility and biological activity. It is believed that organic farming can solve many of these problems as this system is believed to maintain soil

Table 2. Economic improvement in income of farmer in inter cropping system. Specific for the cashew and noni grown during March 2014 to April 2015. Economics have been worked out for the Chikmagalore district.

Sl. No.	Particulars		Inter cropping	Mono cropping
1	Soil organic carbon content		0.92	0.91
1	Total yield/ha (200 plants) Cashew nut in tonne per ha		2.51	2.52
2	Noni Fruit yield per ha (40.50 kg per plant × 175 plants		7.08	00
3	Rate obtained per kg of cashew nut (Raw nuts)		80	80
4	Rate obtained per kg noni fruits in Rs		20	00
5	Total revenue per ha	Cashew	2.08	2.01
		Noni	1.41	0.00
		Total	3.49	2.01
6	Operational cost per ha in lakh	Cashew	0.31	0.31
		Noni	0.25	0.00
		Total	0.56	0.31
7	Total cost of establishment in lakh/ha	Cashew	0.50	0.50
		Noni	0.65	0.00
		Total	1.15	0.50
8	Total cost of production per ha in lakh		1.71	0.81
7	Net profit in lakh per ha		2.93	1.70
8	Benefit cost ratio		3.03	2.48

productivity and pest control by enhancing natural processes and cycles in harmony with environment. Organic farming is favorable to small farmers. They already have the cows and buffalos needed to recycle biomass at the farm level, which is, essentially, the foundation of organic farming [4].

Tremendous potentialities of inter/multiple cropping in Cashew plantations are there to generate employment opportunities for improving the quality of rural life. Hence a study was taken up to assess suitability of cashew and noni, a medicinal plant as a inter crop under organic condition to get a clue about its suitability for plain region of Karnataka.

Materials and Methods

The study was conducted from March 2014 to April 2015 in the cashew nut garden of Mr Nayak Ramaswamy, Survey No 45, 47, which was organically cerified (ICS-1, ICS-2 and ICS-3) under cluster approach organic conversion program of Karnataka State Horticulture Department from March 2010 to March 2013 at Bannur Village, Sakarayapatna Hobli, Kadur Taluk of Chickmagalore District of Karnataka State in India. The said location is classified under central dry zone, situated in the south-western part of Karnataka which lies between 12° 54′ and 13° 53′ North latitude and 75° 04′ and 76° 21′ East longitude and receives annual rainfall of about 1925 mm with maximum temperature of 35°C and minimum of 14°C.

The 9 year old cashew plants of variety Ullal 3 planted at a spacing of 30 × 30 feet (80 plants per acre planted on June 2004 in 5 acre) served as main crop and three year old Noni plants of variety Andamon (70 plants per acre) were planted as intercrop in between four cashew trees. Five plants each from cashew and noni with replications were considered in Inter cropping and mono cropping system under organic condition.

Since study was conducted in organic condition, 20–25 kg of farmyard manure and 2–3 kg of vermincompost were applied along with green manure. Vermiwater waste were sprayed 3 times at 5 ml per liter of water and organically certified Bio N, bio potash and Bio k applied at 250 gm per plant were given in mono cropping and inter cropping system.

The growth parameters such as plant height stem girth, canopy height and canopy diameter in E-W and N-S directions were recorded. Then the ground coverage by canopy was worked out using procedure given below:

$$\text{Radius of canopy (m), } r = \frac{D_1 + D_2}{4}$$

Where, D_1 = canopy diameter in EW direction (m); D_2 = canopy diameter in NS direction (m).

$$\text{Ground coverage by canopy (m}^2\text{), } A = \pi r^2.$$

Per cent ground coverage by canopy = Ground coverage by canopy/actual area on the ground for ex-

ample. Actual area for spacing of 10 m×5 m is 50 m^2.

Cashew nut yield was recorded from four trees in each treatment. The collected nuts were counted and weighed. Fresh and dry weights of a sub sample of 100 nuts from each tree were determined. The dry weight was recorded after sun drying the nuts for three days. The weight per nut including shell was determined at 14% moisture as per the Industrial standard. The nut yield $tree^{-1}$ was calculated as follows:

Nut yield = Mean nut weight × total number of nuts $tree^{-1}$.

Noni fruits were harvested from February to July with 06 pickings. Harvested fruit from five plants of four replicas was collected and weighed.

Data were also collected from secondary sources of information such as reports of Department of Horticulture, Agriculture, and NCOF. Discussions were held with officials of these Departments, experts, executives, to elicit their views, ideas and opinion on the important issues pertaining to Organic farming and its impact.

The data collected for the study were tabulated, processed and analyzed using simple statistical tools like frequency and percentage.

Results and Discussion

When the growth and yield of the plants were compared between the two practices (Table 1), growth of the plants (measured in terms of girth of stem and height of plant) were similar between mono cropping system and inter cropping system of farming. Further, no significant difference in yield of cashew nut were recorded between mono cropping system and inter cropping system of farming.

There was no significant difference in organic carbon content in the soil of mono cropping and inter cropping system (Table 2), which was 1.59 and 1.62 respectively. Organic carbon fractions in the active pool are the main source of energy and nutrients for soil microorganisms. Humus participates in aggregate stability, and nutrient and water holding capacity [5].

In noni, a medicinal plant, average fruit yield per picking was 6.75 kg per plant from February to July, which, in six pickings, yielded 40.50 kg fruits per plant and 7.08 tonnes per ha. Table 2 shows that inter cropping of noni, a medicinal plant in cashew garden under organic system brought the higher benefit cost ratio (Rs 3.03) for cashew farmers compared to farmers of traditional mono cropping system (Rs 2.48).

Conclusion

From the study it can be concluded that, cashew gave consistent and stabilized yield under Inter cropping system, which improved the economic income of the farmer without reducing the yield of main crop. Tremendous potentialities of inter cropping in cashew plantations exist to generate employment opportunities for improving the quality of rural life. Apart from increasing the production of additional crops and employment potential, inter cropping system can acts as a social security against instability of yield such as crops loss due to severe incidence.

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